CONTENTS OF VOLUME 118 · 1999

Oecologia

In Cooperation with the
International Association for Ecology (Intecol)

Editors in Chief

J.R. Ehleringer, Salt Lake City
C. Körner, Basel
M. Schaefer, Göttingen
D.R. Strong, Bodega Bay

Reviews Editor

R. Monson, Boulder

Editorial Board

I. Baldwin, Jena
M.C. Ball, Canberra
F.A. Bazzaz, Cambridge
J. Blondel, Montpellier
W.J. Bond, Rondebosch
R. Brandl, Halle
J.J. Burdon, Canberra
M.M. Caldwell, Logan
B. Casper, Philadelphia
R.L. Chazdon, Storrs
P.D. Coley, Salt Lake City
M.J. Crawley, Ascot
T. Dawson, Ithaca
P. Doherty, Townsville
P.R. Ehrlich, Stanford
K. Fiedler, Bayreuth
L. Flanagan, Lethbridge
H.C.J. Godfray, Ascot
S. Halle, Jena
I. Hanski, Helsinki
A. Hastings, Davis
J.P. Hayes, Reno
H. Heilmeier, Freiberg
T. Hirose, Sendai
P. Högberg, Umeå
L.E. Hurd, Lexington
S. Jonasson, Copenhagen
A. Knapp, Manhattan
S.L. Kohler, Champaign
O.L. Lange, Würzburg
W. Lauenroth, Fort Collins
J.H. Lawton, Ascot
R. Lindroth, Madison
M. Mangel, Santa Cruz
S. McNaughton, Syracuse
D.B. Miles, Athens
K. Nadelhoffer, Woods Hole
K. Nagy, Los Angeles
M. Orell, Oulu
R. Oren, Durham
C. Osenberg, Gainesville
C. Otto, Umeå
J.S. Pate, Nedland
R.W. Pearcy, Davis
C.H. Peterson, Morehead City
S.L. Pimm, Knoxville
L. Pitelka, Frostburg
A. Polle, Göttingen
M. Price, Riverside
J. Rosenheim, Davis
O. Sala, Buenos Aires
J. Sarukhan, Mexico
S. Scheu, Darmstadt
B. Schmid, Zürich
E.-D. Schulze, Jena
J. Shykoff, Orsay
D. Simberloff, Knoxville
K. Spitze, Coral Gables
G. Stewart, Brisbane
A. Stewart-Oaten, Santa Barbara
P. Stiling, Tampa
T. Tscharntke, Göttingen
M.J. Vanni, Oxford
D. Wall, Fort Collins
A. Watkinson, Norwich
M. Westoby, NSW2109
W. Wieser, Innsbruck
V. Wolters, Giessen
D. Yakir, Rehovot
H. Ziegler, München

Oecologia

Derived from "*Zeitschrift für Morphologie und Ökologie der Tiere*", *Oecologia* was founded in 1968, volumes (1968–1982), and edited by H. Remmert. As of volume 53 (1982) the journal has been edited by both H. Remmert and E.-D. Schulze. As of volume 81 (1989) the journal has been edited by J.R. Ehleringer, Salt Lake City; C.H. Peterson, Morehead City; H. Remmert, Marburg; E.-D. Schulze, Bayreuth. As of volume 83 (1990) the journal has been edited by J.R. Ehleringer, Salt Lake City; C.H. Peterson, Morehead City; M. Schaefer, Göttingen; E.-D. Schulze, Bayreuth. As of volume 110 (1997) the journal has been edited by J.R. Ehleringer, Salt Lake City; M. Schaefer, Göttingen; E.-D. Schulze, Bayreuth; D.R. Strong, Bodega Bay. As of volume 115 (1998) the journal has been edited by J.R. Ehleringer, Salt Lake City; M. Schaefer, Göttingen; C. Körner, Basel; D.R. Strong, Bodega Bay.

Copyright

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), all translation rights as well as the rights to publish the article in any electronic form. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher.

The Canada Institute for Scientific and Technical Information (CISTI) provides a comprehensive, world-wide document delivery service for all Springer-Verlag journals. For more information, or to place an order for a copyright-cleared Springer-Verlag document, please contact Client Assistant, Document Delivery, Canada Institute for Scientific and Technical Information, Ottawa K1A OS2, Canada (Tel: 613-993-9251; FAX: 613-952-8243; e-mail: cisti.docdel@nrc.-ca).

The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Special regulations for photocopies in the USA: Photocopies may be made for personal or in-house use beyond the limitations stipulated under Section 107 or 108 of U.S. Copyright Law, provided a fee is paid. All fees should be paid to the Copyright Clearance Center, Inc., 21 Congress Street, Salem, MA 01970, USA, stating the ISSN 0029-8549, the volume, and the first and last page numbers of each article copied. The copyright owner's consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

Printers:

Typesetter: SPS, Madras
Printer:
H. Stürtz AG,
Würzburg

© Springer-Verlag Berlin Heidelberg 1999

Springer-Verlag GmbH & Co. KG,
Berlin, Germany

Printed in Germany

Springer

Contents

Adams III WW → Verhoeven AS
Ammann M, Siegwolf R, Pichlmayer F, Suter M, Saurer M, Brunold C: Estimating the uptake of traffic-derived NO_2 from ^{15}N abundance in Norway spruce needles 124
Anderson MJ: Effects of patch size on colonisation in estuaries: revisiting the species-area relationship 87
Anderson WB, Polis GA: Nutrient fluxes from water to land: seabirds affect plant nutrient status on Gulf of California islands 324
Arias-González JE → Niquil N

Bakker JP → van Wijnen HJ
Bernot RJ → Turner AM
Bertness MD → Leonard GH
Blom CWPM → He JB
Bögemann GM → He JB
Boivin G → Royer L
Boulton AJ → Peterson CG
Boyd RS, Moar WJ: The defensive function of Ni in plants: response of the polyphagous herbivore *Spodoptera exigua* (Lepidoptera: Noctuidae) to hyperaccumulator and accumulator species of *Streptanthus* (Brassicaceae) 218
Bridgham SD → Pastor J
Brunel E → Royer L
Brunold C → Ammann M
Buckley TN, Farquhar GD, Mott KA: Carbon-water balance and patchy stomatal conductance 132

Cain ML, Subler S, Evans JP, Fortin MJ: Sampling spatial and temporal variation in soil nitrogen availability 397
Calmé S, Desrochers A: Nested bird and micro-habitat assemblages in a peatland archipelago 361
Carroll AB → Galen C
Clobert J → Lorenzon P
CMEAL participants → Peterson AG
Cornelissen JHC: A triangular relationship between leaf size and seed size among woody species: allometry, ontogeny, ecology and taxonomy 248
Cory J → Richards A
Crawley MJ → Edwards GR
Crist TO → Golden DM
Curry JP → Schmidt O
Curtis JM → Cyr H
Cyr H, Curtis JM: Zooplankton community size structure and taxonomic composition affects size-selective grazing in natural communities 306

de la Fuente MAS, Marquis RJ: The role of ant-tended extrafloral nectaries in the protection and benefit of a Neotropical rainforest tree 192
Delesalle B → Niquil N
Demmig-Adams B → Verhoeven AS
Desrochers A → Calmé S
Drummond H → Torres R

Edwards GR, Crawley MJ: Rodent seed predation and seedling recruitment in mesic grassland 288
Elamo P, Helander ML, Saloniemi I, Neuvonen S: Birch family and environmental conditions affect endophytic fungi in leaves 151
Elphick MJ, Shine R: Sex differences in optimal incubation temperatures in a scincid lizard species 431
Erneberg M: Effects of herbivory and competition on an introduced plant in decline 203
Evans JP → Cain ML
Ewanchuk PJ → Leonard GH

Faeth SH → Tibbets TM
Farquhar GD → Buckley TN
Fetterolf SA → Turner AM
Fischer M → Völkl W
Fortin MJ → Cain ML
Fournet S → Royer L
Funk JL, Jones CG, Lerdau MT: Defoliation effects on isoprene emission from *Populus deltoides* 333

Galen C, Sherry RA, Carroll AB: Are flowers physiological sinks or faucets? Costs and correlates of water use by flowers of *Polemonium viscosum* 461
Gilbert F → Sadeghi H
Gillon D, Houssard C, Joffre R: Using near-infrared reflectance spectroscopy to predict carbon, nitrogen and phosphorus content in heterogeneous plant material 173
Godfray HCJ → Hodgson DJ
Golden DM, Crist TO: Experimental effects of habitat fragmentation on old-field canopy insects: community, guild and species responses 371
Gordon IJ → Pérez-Barbería FJ
Gross KL → Kosola KR

Harley PC, Monson RK, Lerdau MT: Ecological and evolutionary aspects of isoprene emission from plants 109
Hättenschwiler S, Schafellner C: Opposing effects of elevated CO_2 and N deposition on *Lymantria monacha* larvae feeding on spruce trees 210
Hay ME → Sotka EE
He JB, Bögemann GM, van de Steeg HM, Rijnders JGHM, Voesenek LACJ, Blom CWPM: Survival tactics of *Ranunculus* species in river floodplains 1
Helander ML → Elamo P
Hellsten M, Lagergren R, Stenson J: Can extreme morphology in *Bosmina* reduce predation risk from *Leptodora*? An experimental test 23
Hemborg AM, Karlsson PS: Sexual differences in biomass and nutrient allocation of first-year *Silene dioica* plants 453
Hikosaka K, Sudoh S, Hirose T: Light acquisition and use by individuals competing in a dense stand of an annual herb, *Xanthium canadense* 388
Hilker M → Müller C
Hirose T → Hikosaka K
Hobbie EA, Macko SA, Shugart HH: Insights into nitrogen and carbon dynamics of ectomycorrhizal and saprotrophic fungi from isotopic evidence 353
Hodgson DJ, Godfray HCJ: The consequences of clustering by *Aphis fabae* foundresses on spring migrant production 446
Hoffmann KH → Völkl W
Holbrook SJ → Schmitt RJ
Houssard C → Gillon D
Hugueny B → Mérigoux S

Joffre R → Gillon D
John-Alder H → Lorenzon P
Jones CG → Funk JL

Karlsson PS → Hemborg AM
Korb J, Linsenmair KE: Reproductive success of *Macrotermes bellicosus* (Isoptera, Macrotermitinae) in two neighbouring habitats 183
Körner Ch → Leadley PW
Kosola KR, Gross KL: Resource competition and suppression of plants colonizing early successional old fields 69

Lagergren R → Hellsten M
Leadley PW, Niklaus PA, Stocker R, Körner Ch: A field study of the effects of elevated CO_2 on plant biomass and community structure in a calcareous grassland 39
Lebreton JD → Oro D
Leonard GH, Ewanchuk PJ, Bertness MD: How recruitment, intraspecific interactions, and predation control species borders in a tidal estuary 492
Lerdau MT → Funk JL
Lerdau MT → Harley PC
Linsenmair KE → Korb J
Lorenz MW → Völkl W
Lorenzon P, Clobert J, Oppliger A, John-Alder H: Effect of water constraint on growth rate, activity and body temperature of yearling common lizard (*Lacerta vivipara*) 423

Macko SA → Hobbie EA
Marquis RJ → de la Fuente MAS
McCormick MI: Experimental test of the effect of maternal hormones on larval quality of a coral reef fish 412
Mérigoux S, Hugueny B, Ponton D, Statzner B, Vauchel P: Predicting diversity of juvenile neotropical fish communities: patch dynamics versus habitat state in floodplain creeks 503
McIntosh AR, Peckarsky BL, Taylor BW: Rapid size-specific changes in the drift of *Baetis bicaudatus* (Ephemeroptera) caused by alterations in fish odour concentration 256
Miyasaka H, Nakano S: Effects of drift- and benthic-foraging fish on the drift dispersal of three species of mayfly nymphs in a Japanese stream 99
Moar WJ → Boyd RS
Møller AP → Soler JJ

Monson RK → Harley PC
Mott KA → Buckley TN
Müller C, Hilker M: Unexpected reactions of a generalist predator towards defensive devices of cassidine larvae (Coleoptera, Chrysomelidae) 166

Nakano S → Miyasaka H
Neuvonen S → Elamo P
Niklaus PA → Leadley PW
Niquil N, Arias-González JE, Delesalle B, Ulanowicz RE: Characterization of the planktonic food web of Takapoto Atoll lagoon, using network analysis 232

Oppliger A → Lorenzon P
Oro D, Pradel R, Lebreton JD: Food availability and nest predation influence life history traits in Audouin's gull, *Larus audouinii* 438

Paige KN: Regrowth following ungulate herbivory in *Ipomopsis aggregata*: geographic evidence for overcompensation 316
Pastor J, Bridgham SD: Nutrient efficiency along nutrient availability gradients 50
Peckarsky BL → McIntosh AR
Peterson AG, CMEAL participants: Reconciling the apparent difference between mass- and area-based expressions of the photosynthesis-nitrogen relationship 144
Peterson CG, Boulton AJ: Stream permanence influences microalgal food availability to grazing tadpoles in arid-zone springs 340
Pérez-Barbería FJ, Gordon IJ: The functional relationship between feeding type and jaw and cranial morphology in ungulates 157
Pichlmayer F → Ammann M
Polis GA → Anderson WB
Ponton D → Mérigoux S
Pradel R → Oro D

Richards A, Cory J, Speight M, Williams T: Foraging in a pathogen reservoir can lead to local host population extinction: a case study of a Lepidoptera-virus interaction 29
Rijnders JGHM → He JB
Royer L, Fournet S, Brunel E, Boivin G: Intra- and interspecific host discrimination by host-seeking larvae of coleopteran parasitoids 59
Russell RW: Precipitation scrubbing of aerial plankton: inferences from bird behavior 381

Sadeghi H, Gilbert F: Individual variation in oviposition preference, and its interaction with larval performance in an insect predator 405
Saloniemi I → Elamo P
Saurer M → Ammann M
Schafellner C → Hättenschwiler S
Schmidt O, Scrimgeour CM, Curry JP: Carbon and nitrogen stable isotope ratios in body tissue and mucus of feeding and fasting earthworms (*Lumbricus festivus*) 9
Schmitt RJ, Holbrook SJ: Settlement and recruitment of three damselfish species: larval delivery and competition for shelter space 76
Scrimgeour CM → Schmidt O
Sherry RA → Galen C
Shine R → Elphick MJ
Shugart HH → Hobbie EA
Siegwolf R → Ammann M
Soler JJ, Møller AP, Soler M: A comparative study of host selection in the European cuckoo *Cuculus canorus* 265
Soler M → Soler JJ
Sotka EE, Hay ME, Thomas JD: Host-plant specialization by a non-herbivorous amphipod: advantages for the amphipod and costs for the seaweed 471
Speight M → Richards A
Statzner B → Mérigoux S
Stenson J → Hellsten M
Stocker R → Leadley PW
Subler S → Cain ML
Sudoh S → Hikosaka K
Suter M → Ammann M

Taylor BW → McIntosh AR
Thomas JD → Sotka EE
Tibbets TM, Faeth SH: *Neotyphodium* endophytes in grasses: deterrents or promoters of herbivory by leaf-cutting ants? 297
Torres R, Drummond H: Variably male-biased sex ratio in a marine bird with females larger than males 16
Turner AM, Fetterolf SA, Bernot RJ: Predator identity and consumer behavior: differential effects of fish and crayfish on the habitat use of a freshwater snail 242

Ulanowicz RE → Niquil N

van de Steeg HM → He JB
van der Wal R → van Wijnen HJ
van Wijnen HJ, van der Wal R, Bakker JP: The impact of herbivores on nitrogen mineralization rate: consequences for salt-marsh succession 225
Vauchel P → Mérigoux S
Verhoeven AS, Adams III WW, Demmig-Adams B: The xanthophyll cycle and acclimation of *Pinus ponderosa* and *Malva neglecta* to winter stress 277
Voesenek LACJ → He JB
Völkl W, Woodring J, Fischer M, Lorenz MW, Hoffmann KH: Ant-aphid mutualisms: the impact of honeydew production and honeydew sugar composition on ant preferences 483

Williams T → Richards A
Woodring J → Völkl W

Indexed in *Current Contents*

Index of key words

Achillea millefolium 69
Acromyrmex 297
Adaptation 423
Adult survival 438
Aerenchyma 1
Aerial plankton 381
Aggregation 446
Aleochara spp. 59
Allometric 248
Ambrosia artemisiifolia 69
Amphipod 471
Ant-plant interaction 192
Anthemis cotula 203
Aphididae 483
Aphis fabae 446
Arid-zone stream 340
Ascendency 232
Atoll lagoon 232
Atriplex 324

Bassiana duperreyi 431
Behavioural response 423
Belowground competition 69
Betula pubescens subsp. *czerepanovii* 151
Biogeochemical cycling 225
Bird 361
Bosmina 23
Boundary layer 132
Breeding dispersal 438
Bromus erectus 39
Brood parasitism 265
Brook trout 256

Calcareous grassland 39
Carbon allocation 333
Carbon isotope ratio 353
Carbon turnover 9
Cassida spp 166
Cell size 461
Chemical cues 256
Chloroplast condition 340
Cladocera 23
Clonal fitness 446
Coastal dune ecosystems 397
Community size structure 306
Comparative method 157
Compensation 203
Competition 76
Conservation 361
Coral reef fishes 471
Corolla size 461
Cortisol 412
Cost of reproduction 461
Cuckoo Host abundance 265

Daphnia 306
Dascyllus 76
Defoliation 333
Density-dependent foraging 492
Desert nutrients *Opuntia* 324
Diet 9
Dioecy 453

Dispersal 29
Distribution 183
Diversity 371

Earthworms 9
Ecological strategy 248
Ectatomma ruidum 192
Elemental defense 218
Elevated CO_2 39
Embryo 431
Endophytic fungi 151, 297
Energy dissipation 277
Environmental constraints 423
Epilithic algae 340
Euclystis sp. 192

Faeces 166
Feeding selectivity 306
Feeding type 157
Festuca 297
Field experiment 371
Fish foraging modes 99
Fish larvae 412
Fitness 183
Flight behavior 381
Flow-mediated recruitment 492
Flower size 461
Food web 232
Foraging 29
Forests 124

Genotype × environment interaction 151
Geographic variation 316
Global versus local calibrations 173
Goose 225
Grazing 306, 340
Gust front 381
Gut passage 340

Habitat diversity 503
Habitat selection 242
Habitat specificity 371
Halimeda 471
Hare 225
Herbivory 192, 210, 218, 225
Honeydew 483
Host characteristics 265
Host discrimination 59
Host-parasite coevolution 265
Host-plant specialist 471
Hydrocarbons 109
Hydrological variability 503

Indirect effects 242
Individual variation 405
Insectivorous birds 381
Interannual variation 16
Interspecific competition 203
Intertidal ecology 87
Intraspecific competition 388
Invasion barrier 203
Invertebrate herbivory 203
Ion exchange membrane spikes 397
Ipomopsis aggregata 316
Irretrievable resource 453
Island habitat 87
Isoprene 109
Isoprene emission 333

Jaw 157

Kairomone 166

Larval quality 412
Larval shield 166
Leaf area 248
Leaf mass per area 144
Leaf nitrogen 144
Leptodora 23
Lifetime reproductive success 183
Light acquisition 388
Light use efficiency 388
Litter 173, 225
Litterfall 50
Low-temperature stress 277

Malva neglecta 277
Manipulative field experiments 99
Maternal effects 412
Mesobromion 39
Morphological defences 23
Mountain birch 151
Mucus 9
Multiparasitism 59
Mutualism 297, 483
Ant attendance 483
Mycorrhizal fungi 353
Myrmica rubra 166

^{15}N 124
Natural enemies 446
Neotyphodium 297
Nestedness 361
Network analysis 232
New England rocky intertidal zone 492
Ni accumulation 218
Ni hyperaccumulation 218
Nitrogen acquisition 69
Nitrogen dynamics 353
Nitrogen economy 210
Nitrogen isotope ratio 353
NO_2 deposition 124
Nucleopolyhedrovirus 29
Nutrient 173
Nutrient allocation 453
Nutrient availability 50
Nutrient response efficiency 50
Nutrient use efficiency 50

Odour concentration 256
Old-field succession 69
Olfactory marker 59
Ontogenetic 248
Optimal 132
Overcompensation 316

Patchy 132
Pathogen reservoir 29
Pattern of distribution 361
Peatland 361
Phenotype 431
Phenotypic plasticity 423
Photosynthesis 1, 144
Physella 242
Phytochemistry 210
Picea abies 124, 210
Pine needles 173
Pinus ponderosa 277
Plankton 232
Plant-animal interactions 471
Plant-insect interactions 210
Population dynamics 438
Populus deltoides 333
Positive interactions 492
Post-settlement processes 76
Precipitation scrubbing 381
Predation 23
Predator avoidance 242
Predator-prey interactions 99
Predators 405
Preference-performance interaction 405
Prescribed burning 173
Prey size 256
Primary host 446
Production 50
Pumpkinseed sunfish 242

Random placement hypothesis 87
Ranunculus 1
Rarity 371
Recruitment 76
Reproductive effort 453
Reproductive performance 438
Reptile 431
Resource economy 453

Savannah 183
Seabird guano 324
Seasonal variation 16, 87
Seed density 288
Seed weight 248
Seedling emergence 288
Serpentine 218
Settlement 76
Sex ratio 16
Shoot elongation 1
Size dimorphism 16
Size inequality 388
Skull 157
Small mammal 288
Soil nitrogen availability 397
Soil resource heterogeneity 397
Spatial statistics 397
Spatial subsidies 324
Species borders 492
Species diversity 39
Species richness 371, 503
Spruce 124
Stable isotopes 9
Stomata 132
Stream enclosures 99
Stream predator-prey interactions 256
Sublethal effects 99
Succession 87, 353
Sugar preferences 483
Sula nebouxii 16
Superparasitism 59
Survival of flooding 1
Syrphidae 405

Temporal variation in soil resources 397
Termites 183
Testosterone 412
Thermal 431
Transmission 29

Ungulate herbivory 316
Ungulates 157

Volatile organic carbon 109

Wasmannia auropunctata 192
Water use 461
Water-use efficiency 132
Whole-plant resource integration 333
Whole-plant photosynthesis 388

Xanthophyll cycle 277

Young fish 503

Zeaxanthin 277
Zooplankton 306